

Claims

- [c1] 1. A method for coordinating torque demand amongst a plurality of torque producing devices in an automotive vehicle, the method comprising:
- receiving information defining at least one torque production limitation for a first torque producing device;
 - determining a request for torque;
 - comparing the request for torque with the at least one first torque producing device torque production limitation;
 - if the comparison results in the request for torque exceeding one of the at least one first torque producing device torque production limitation,
 - (a) determining a first excess requested torque as the difference between the request for torque and the exceeded first torque producing device torque production limitation,
 - (b) determining as the first coordinated torque request the exceeded first torque producing device torque production limitation, and
 - (c) determining as the second coordinated torque request the first excess requested torque;
 - sending the first coordinated torque request to the first

torque producing device; and
sending the second coordinated torque request to at least one second torque producing device.

[c2] 2. The method of claim 1 further comprising, if the comparison does not result in the request for torque exceeding one of the at least one first torque producing device torque production limitation, determining as a first coordinated torque request the request for torque and determining a null torque as a second coordinated torque request.

[c3] 3. The method according to claim 1 further comprising:
receiving information defining at least one torque production limitation for the at least one second torque producing device;
comparing the first excess requested torque with the at least one second torque producing device torque production limitation; and
if the first excess requested torque exceeds any second torque producing device torque production limitation, sending as the second coordinated torque an exceeded second torque producing device torque production limitation.

[c4] 4. The method according to claim 3 further comprising:
determining a second excess requested torque as the

difference between the first excess requested torque and the exceeded second torque producing device torque production limitation; and
determining as the first coordinated torque request the sum of the exceeded first torque producing device torque production limitation and the second excess requested torque.

[c5] 5. The method according to claim 4 further comprising:
comparing the sum of the exceeded first torque producing device torque production limitation and the second excess requested torque with the at least one first torque producing device torque production limitation;
and
if the sum of the exceeded first torque producing device torque production limitation and the second excess requested torque is greater than an exceeded first torque producing device torque production limitation, determining as the first coordinated torque request the exceeded first torque producing device torque production limitation.

[c6] 6. The method according to claim 1 wherein the first torque producing device comprises an engine and the at least one second torque producing device comprises a motor.

- [c7] 7. The method according to claim 1 wherein the comparison is performed at a wheel level and the first torque producing device generates torque at a transmission input level, the method further comprising translating information defining at least one torque production limitation for the first torque producing device through any transmission effects between the transmission input level and the wheel level.
- [c8] 8. The method according to claim 1 wherein the comparison is performed at a transmission input level and the first torque producing device generates torque at a wheel level, the method further comprising translating at least one of the first coordinated torque request and the second coordinated torque request through any transmission effects between the wheel level and the transmission input level.
- [c9] 9. The method according to claim 1 wherein the request for torque is determined by summing a plurality of torque requests.
- [c10] 10. A vehicle comprising:
an engine operative to receive commands for generating a first torque;
at least one motor operative to receive commands for generating a second torque;

at least one source of torque requests; and
control logic in communication with the engine, the at
least one motor and the at least one source of torque re-
quests, the control logic operative to

- (a) determine a torque request,
- (b) determine as an initial coordinated torque
request the determined torque request limited by at least
one engine torque limit,
- (c) determine as a first excess requested torque
a difference between the received torque request and the
initial coordinated torque request,
- (d) determine as a second coordinated torque
request the first excess requested torque limited by at
least one motor torque limit,
- (e) determine as a second excess requested torque
a difference between the first excess requested torque
and the second coordinated torque request, and
- (f) determine as a first coordinated torque
request a sum of the initial coordinated torque request
and the second excess requested torque.

[c11] 11. The vehicle according to claim 10 further comprising
limiting the sum of the initial coordinated torque request
and the second excess requested torque by the at least
one engine torque limit to determine the first coordi-
nated torque request.

- [c12] 12. The vehicle according to claim 10 further comprising sending the first coordinated torque request as the commands for generating the first torque.
- [c13] 13. The vehicle according to claim 10 further comprising sending the second coordinated torque request as the commands for generating the second torque.
- [c14] 14. The vehicle according to claim 10 further comprising a transmission for converting the first torque from a transmission input level to a wheel level driving a first axle and wherein the at least one motor comprises at least one motor mechanically connected to a second axle.
- [c15] 15. The vehicle according to claim 14 wherein the control logic determines the first coordinated torque request as a first axle torque request at the wheel level and determines the second coordinated torque request as a second axle torque request at the wheel level.
- [c16] 16. The vehicle according to claim 15 wherein the control logic is further operative to translate at least one of the first axle torque request and the second axle torque request from the wheel level to the transmission input level based on at least one parameter of the transmission.

- [c17] 17. The vehicle according to claim 16 wherein the control logic is further operative to coordinate torque requests based on at least one of the translated first axle torque request and the translated second axle torque request to determine commands for generating the first torque and commands for generating the second torque.
- [c18] 18. The vehicle according to claim 14 further comprising a traction controller operative to determine a balancing torque request to reduce a difference in speed between the first axle and the second axle, the control logic determining the initial coordinated torque request as a difference between the determined torque request and the balancing torque request, this difference limited by the at least one engine torque limit.
- [c19] 19. The vehicle according to claim 10 wherein the determined torque request comprises an arbitrated driver request exceeding an ability for the engine to generate as the first torque, the control logic determining the second coordinated torque request as a power assist request.
- [c20] 20. The vehicle according to claim 10 wherein the determined torque request is a negative torque request, the control logic determining the second coordinated torque request as a regenerative braking request.

[c21] 21. The vehicle according to claim 10 further comprising at least one battery controller operative to determine a charging torque request to change a state of charge of at least one battery using at least one motor mechanically connected to at least one of the first axle and the second axle, the control logic determining the initial coordinated torque request as a sum of the determined torque request and the charging torque request, this sum limited by at least one engine torque limit.